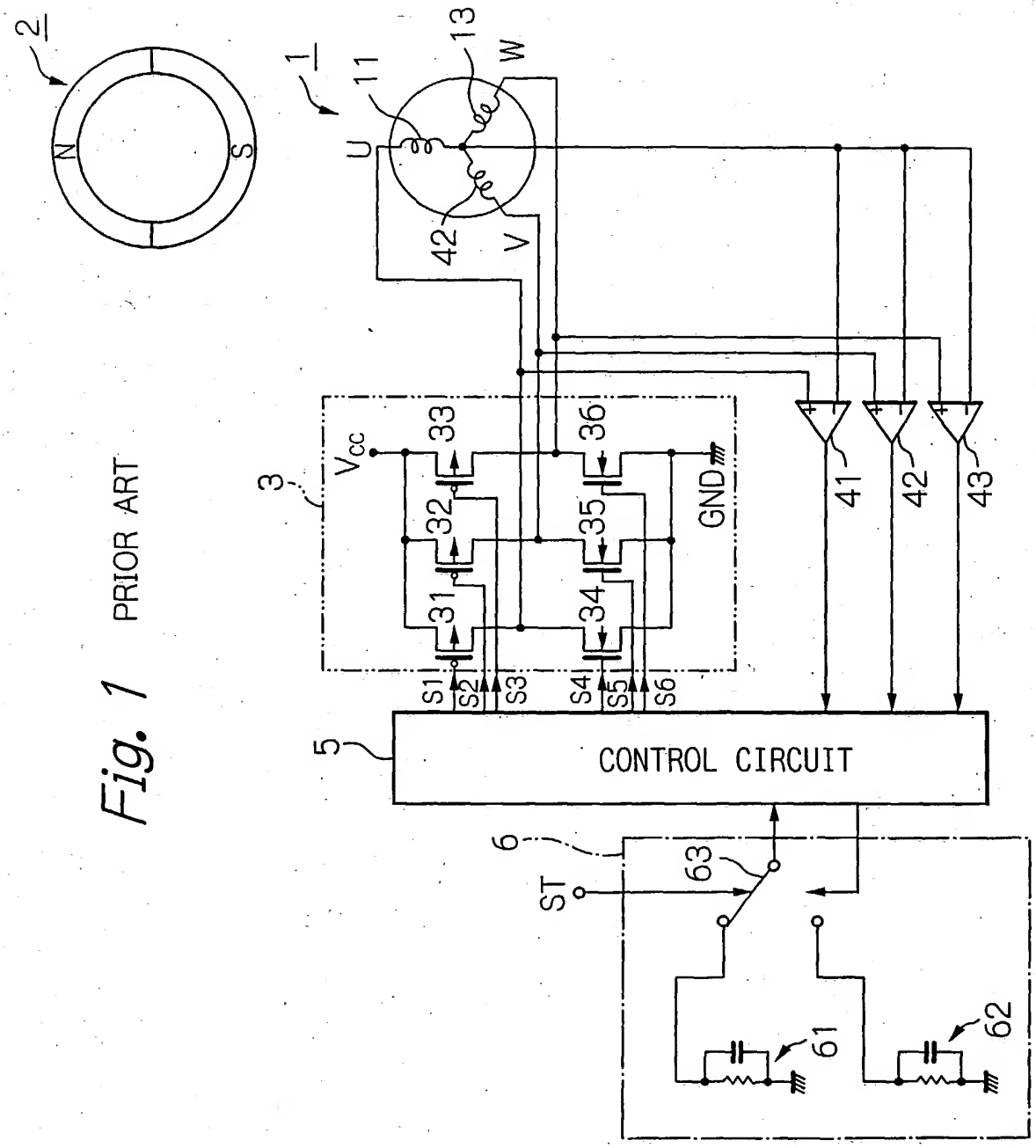


Fig. 1 PRIOR ART

Fig. 2 PRIOR ART

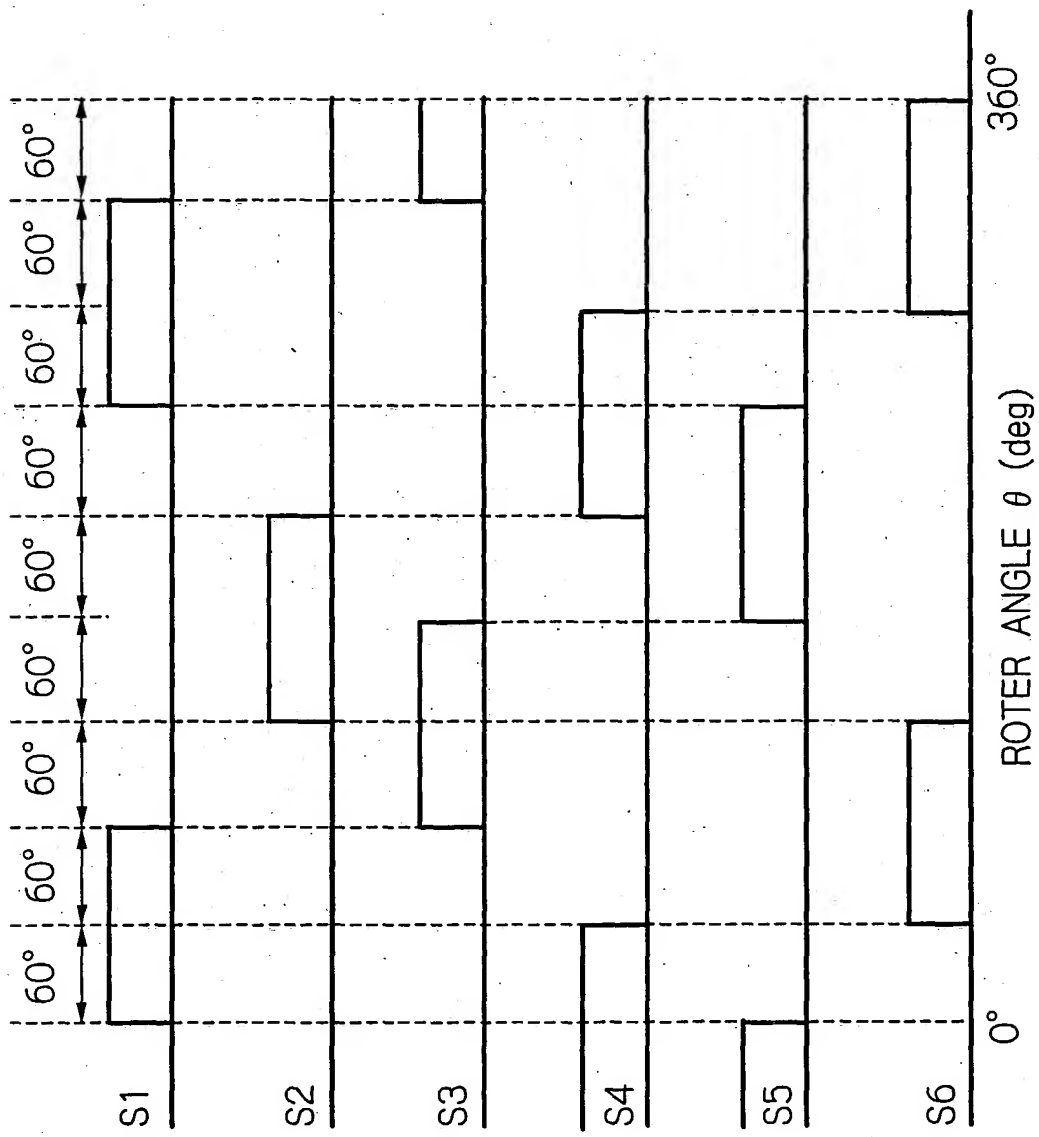


Fig. 3

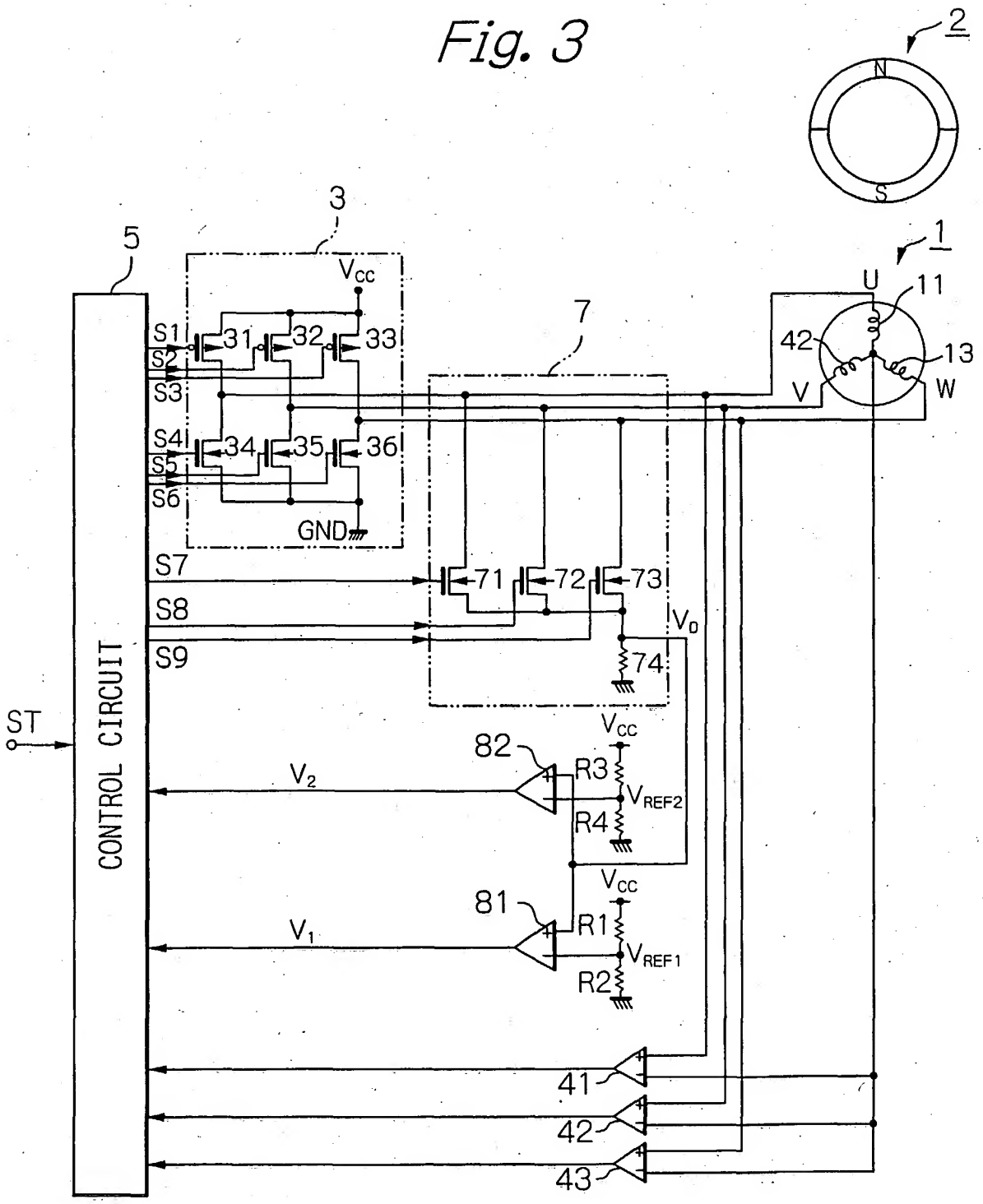

2
N
S
1
3
5
7
U
V
W
11
13
42
V_{CC}
S1
S2
S3
S4
S5
S6
31
32
33
34
35
36
GND
S7
S8
S9
71
72
73
74
V_D
ST
CONTROL CIRCUIT
82
81
R3
R4
R1
R2
V_{REF2}
V_{REF1}
V_2
V_1
41
42
43

Fig. 4

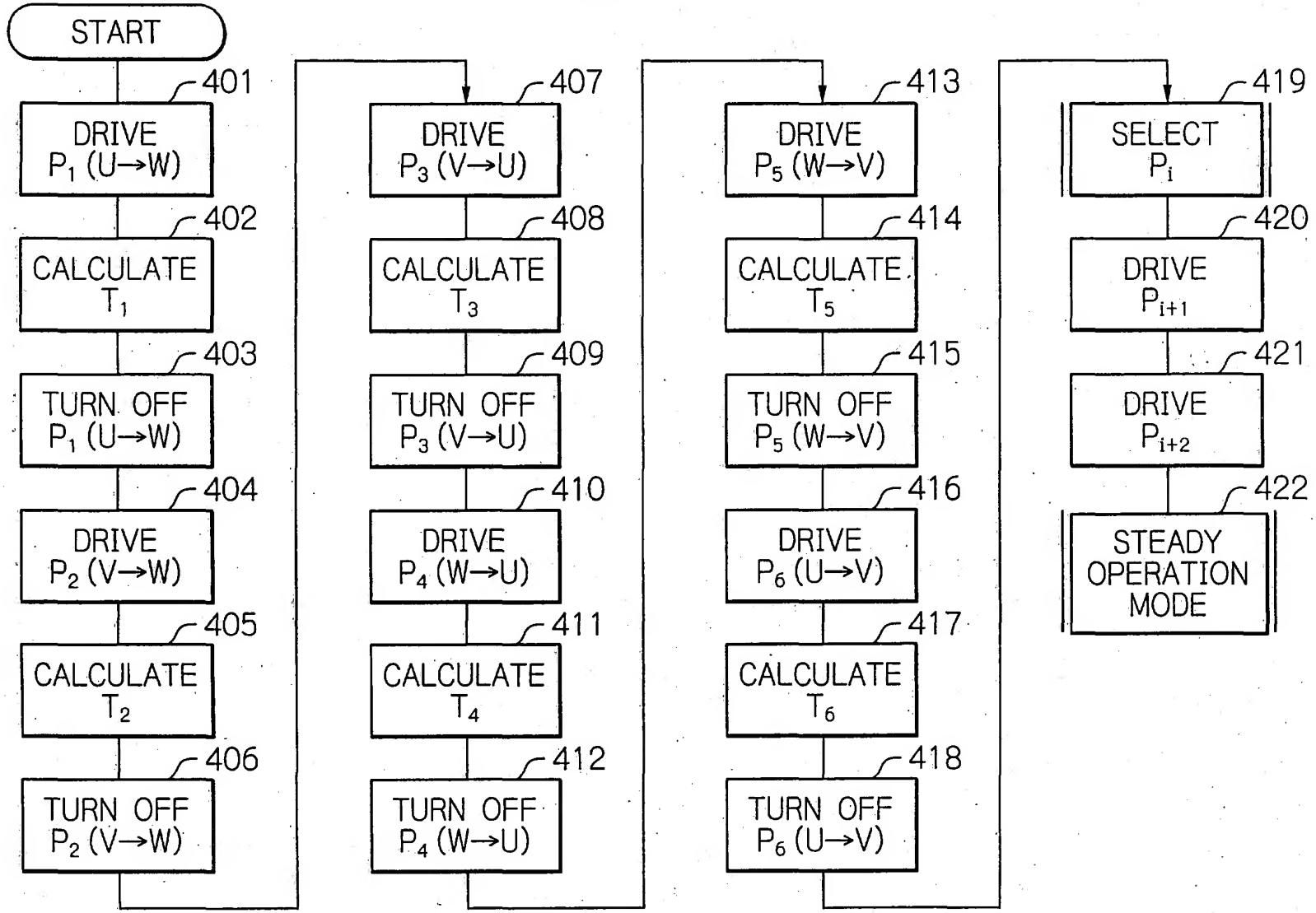

START
401
DRIVE P1 (U→W)
402
CALCULATE T1
403
TURN OFF P1 (U→W)
404
DRIVE P2 (V→W)
405
CALCULATE T2
406
TURN OFF P2 (V→W)
407
DRIVE P3 (V→U)
408
CALCULATE T3
409
TURN OFF P3 (V→U)
410
DRIVE P4 (W→U)
411
CALCULATE T4
412
TURN OFF P4 (W→U)
413
DRIVE P5 (W→V)
414
CALCULATE T5
415
TURN OFF P5 (W→V)
416
DRIVE P6 (U→V)
417
CALCULATE T6
418
TURN OFF P6 (U→V)
419
SELECT Pi
420
DRIVE Pi+1
421
DRIVE Pi+2
422
STEADY OPERATION MODE

Fig. 5

DRIVER PHASE	CURRENT
P_1	U → W
P_2	V → W
P_3	V → U
P_4	W → U
P_5	W → V
P_6	U → V

Fig. 6

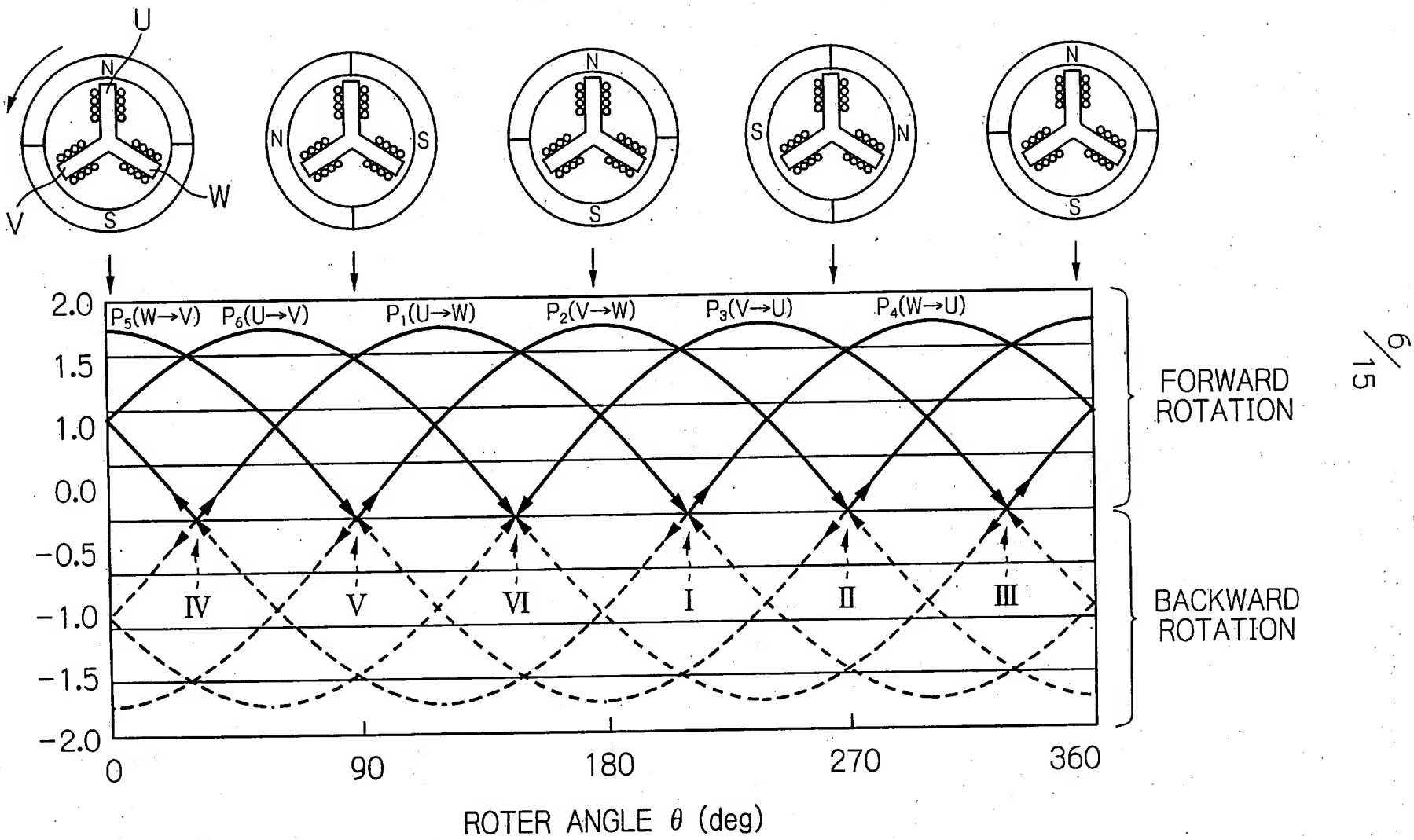

U
V
W
N
S
2.0
1.5
1.0
0.0
-0.5
-1.0
-1.5
-2.0
P5(W→V)
P6(U→V)
P1(U→W)
P2(V→W)
P3(V→U)
P4(W→U)
IV
V
VI
I
II
III
FORWARD ROTATION
BACKWARD ROTATION
0
90
180
270
360
ROTER ANGLE θ (deg)

Fig. 7

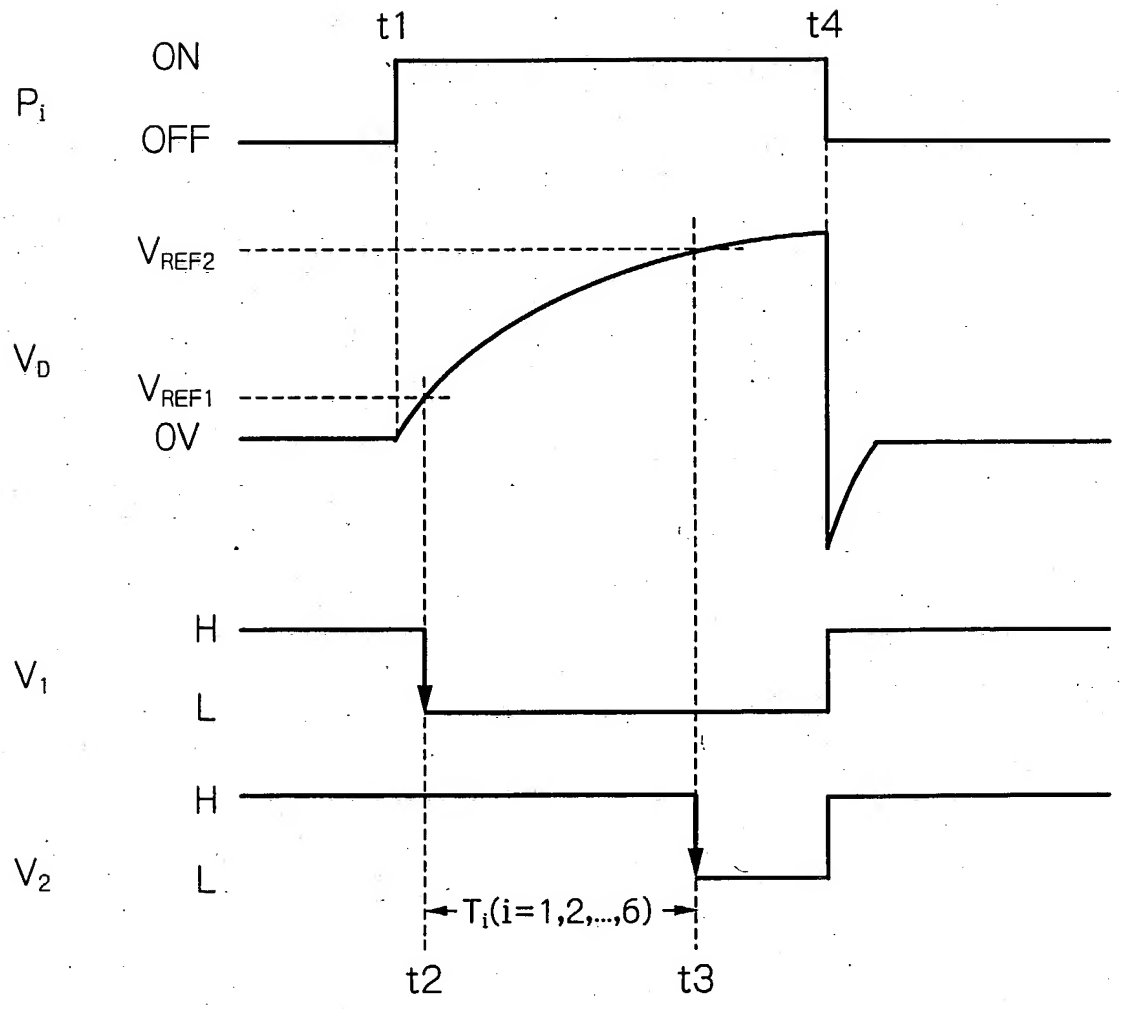
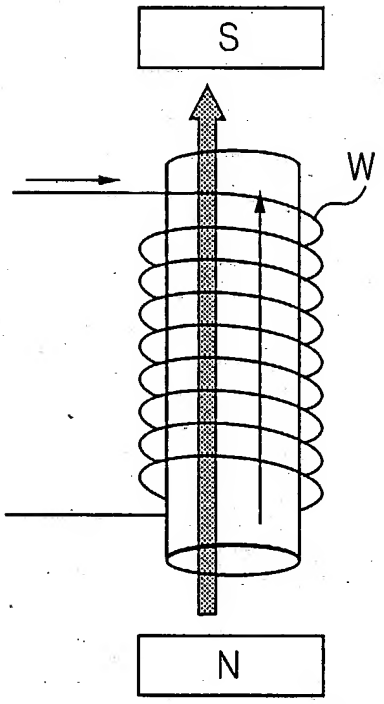
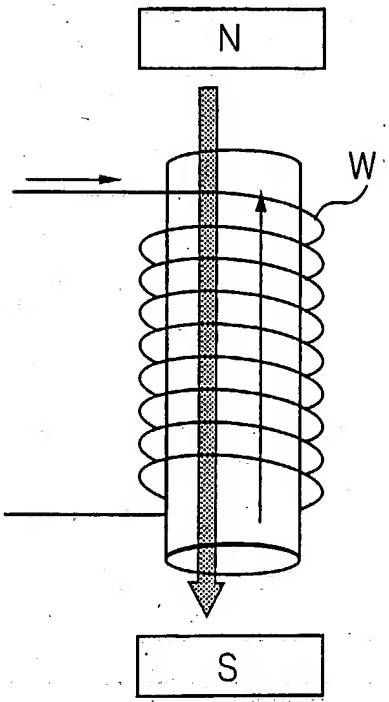


Fig. 8A



L : MINIMUM

Fig. 8B



L : MAXIMUM

Fig. 9

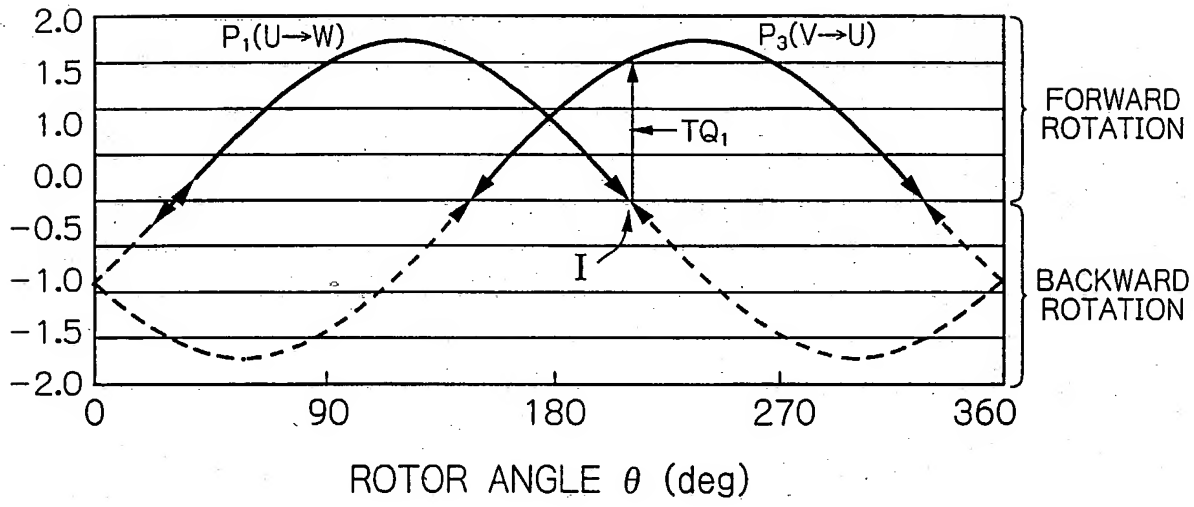

2.0
1.5
1.0
0.0
-0.5
-1.0
-1.5
-2.0
0
90
180
270
360
P1(U→W)
P3(V→U)
TQ1
I
FORWARD ROTATION
BACKWARD ROTATION
ROTOR ANGLE θ (deg)

Fig. 10A

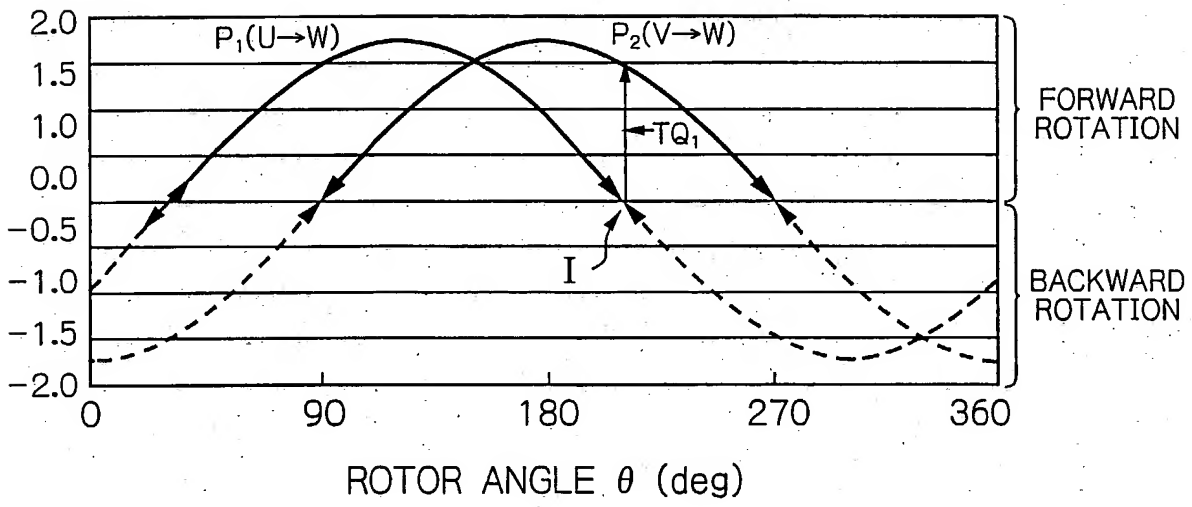


Fig. 10B

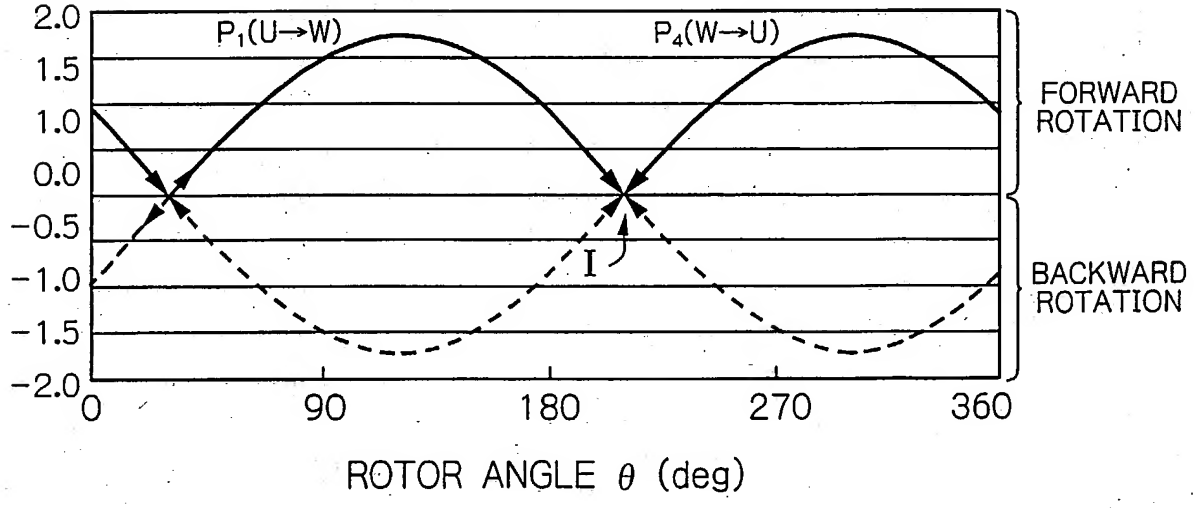
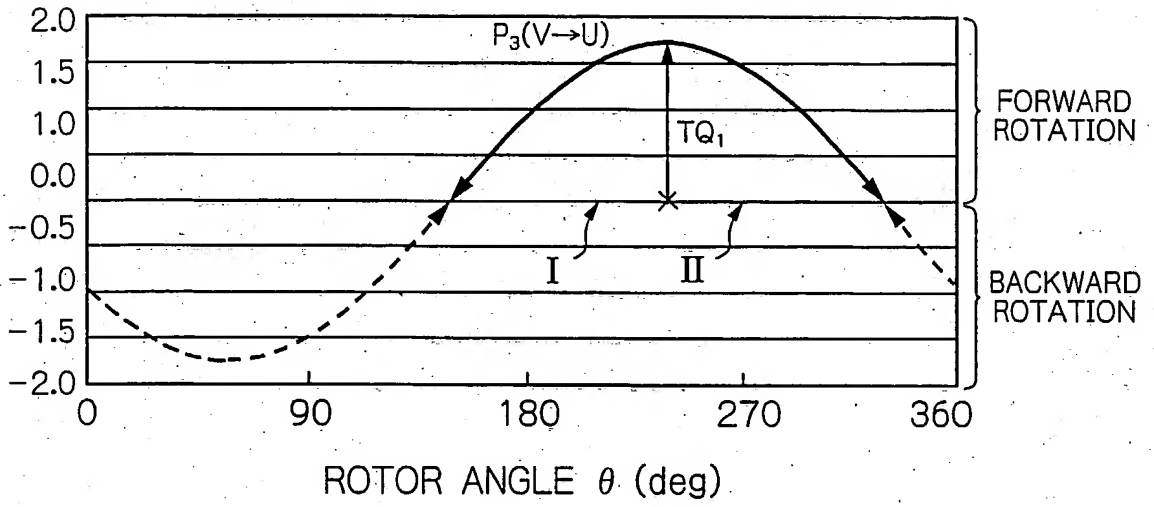


Fig. 11A



θ

Fig. 11B

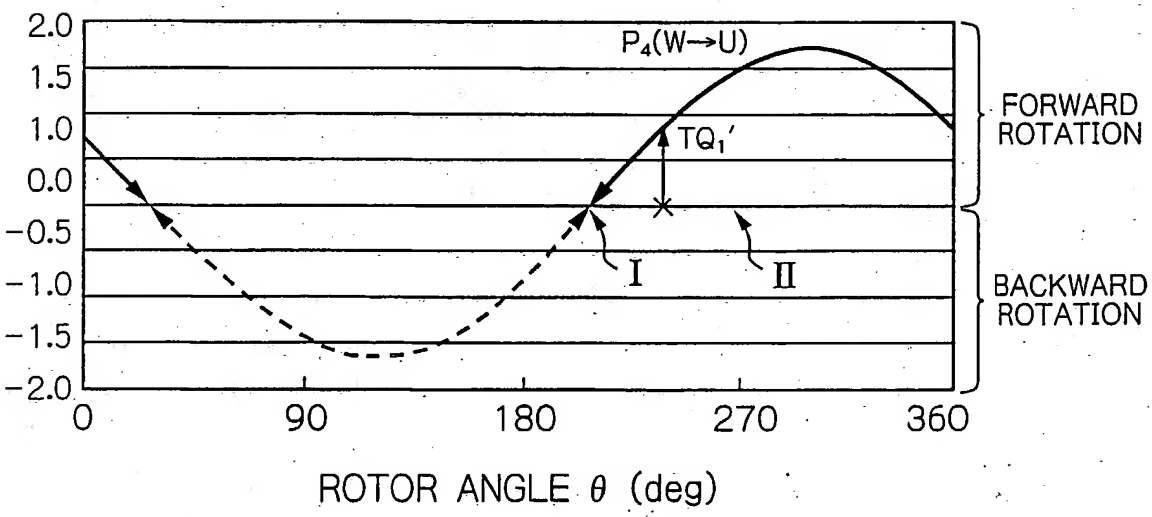


Fig. 12

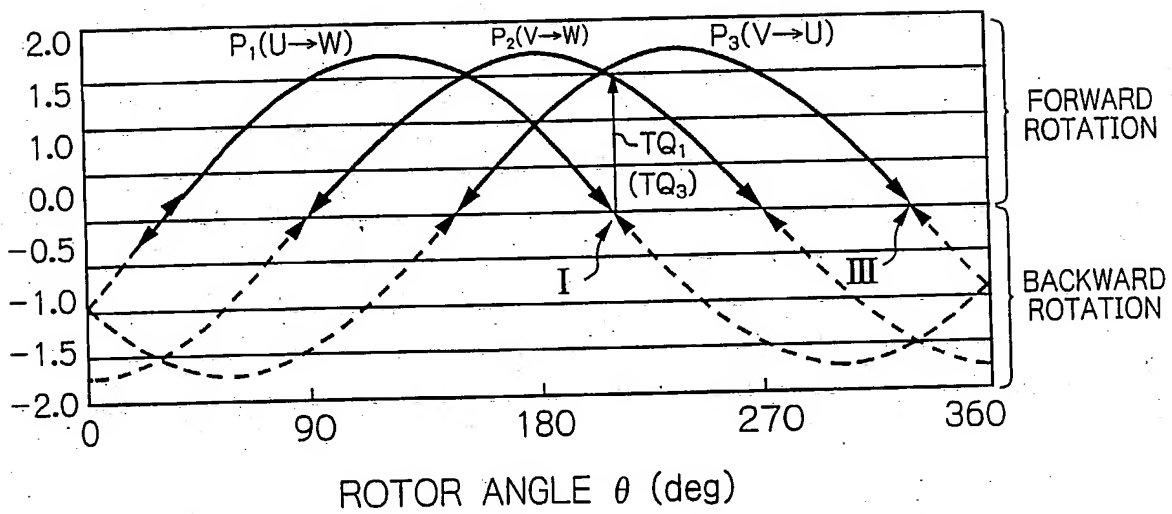

2.0
1.5
1.0
0.0
−0.5
−1.0
−1.5
−2.0
0
90
180
270
360
P1(U→W)
P2(V→W)
P3(V→U)
TQ1
(TQ3)
I
III
FORWARD ROTATION
BACKWARD ROTATION
ROTOR ANGLE θ (deg)

Fig. 13A

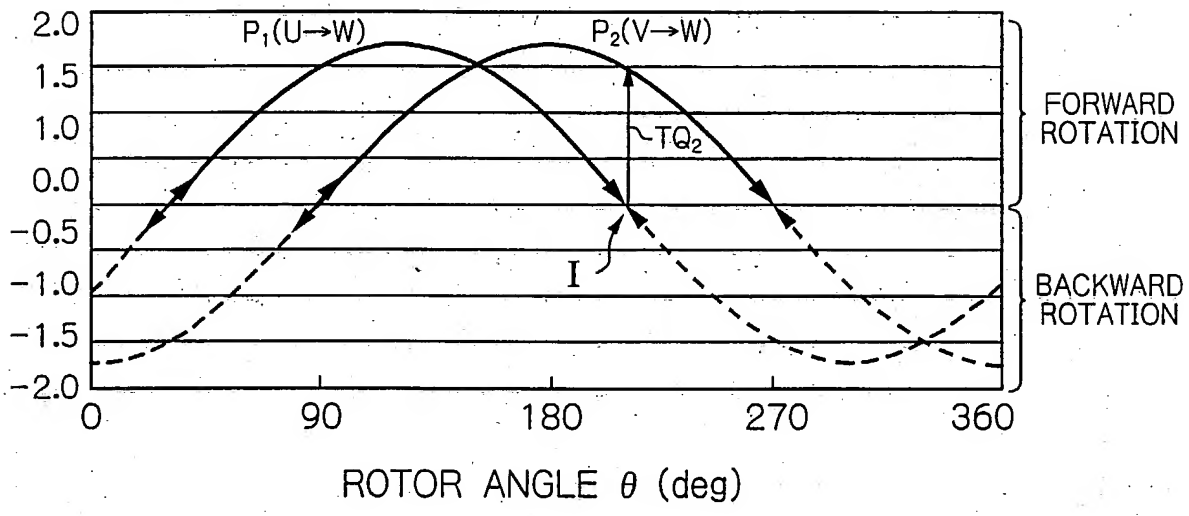


Fig. 13B

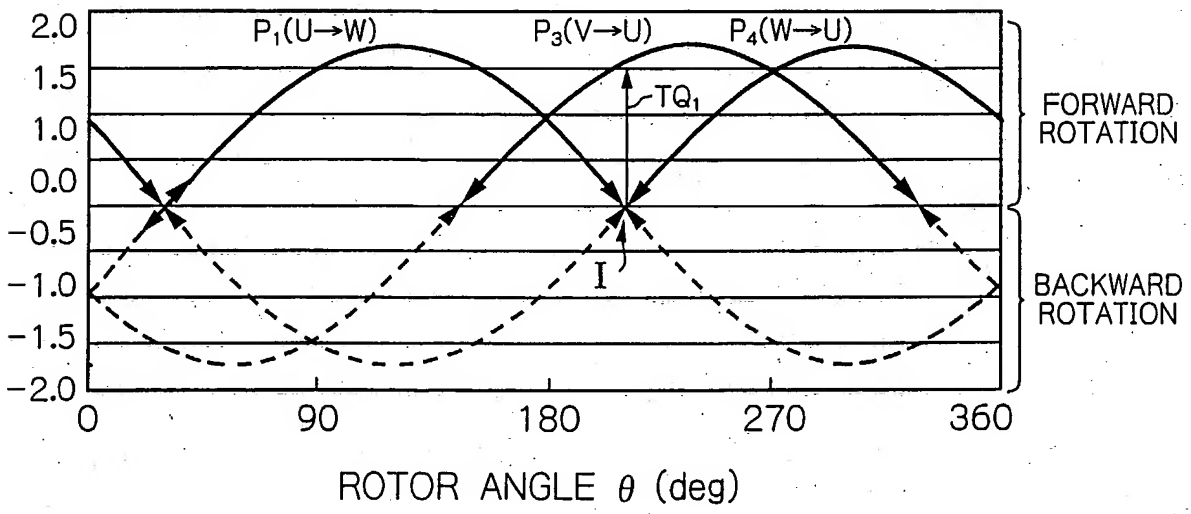


Fig. 14A

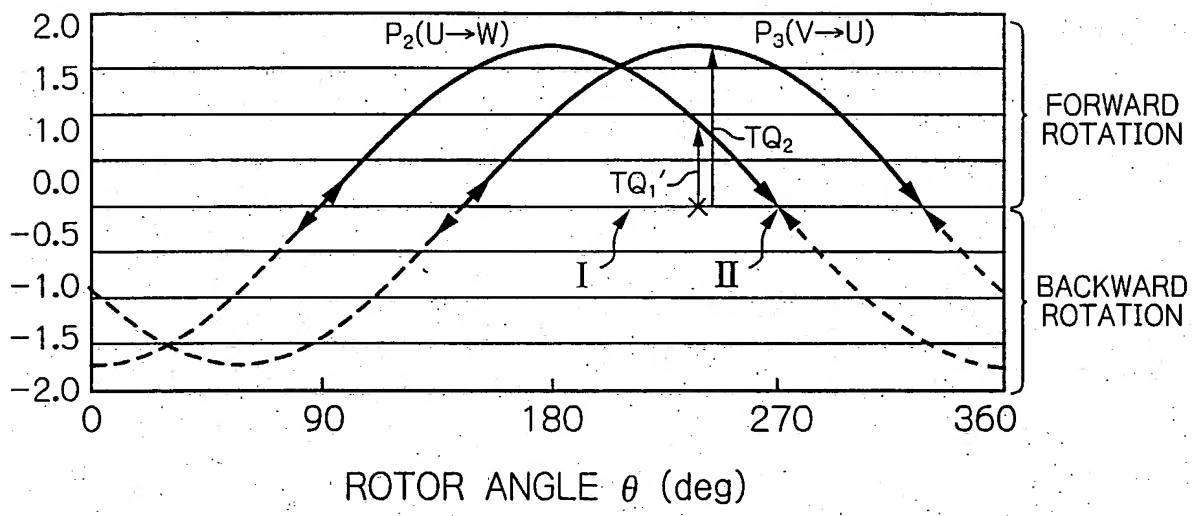


Fig. 14B

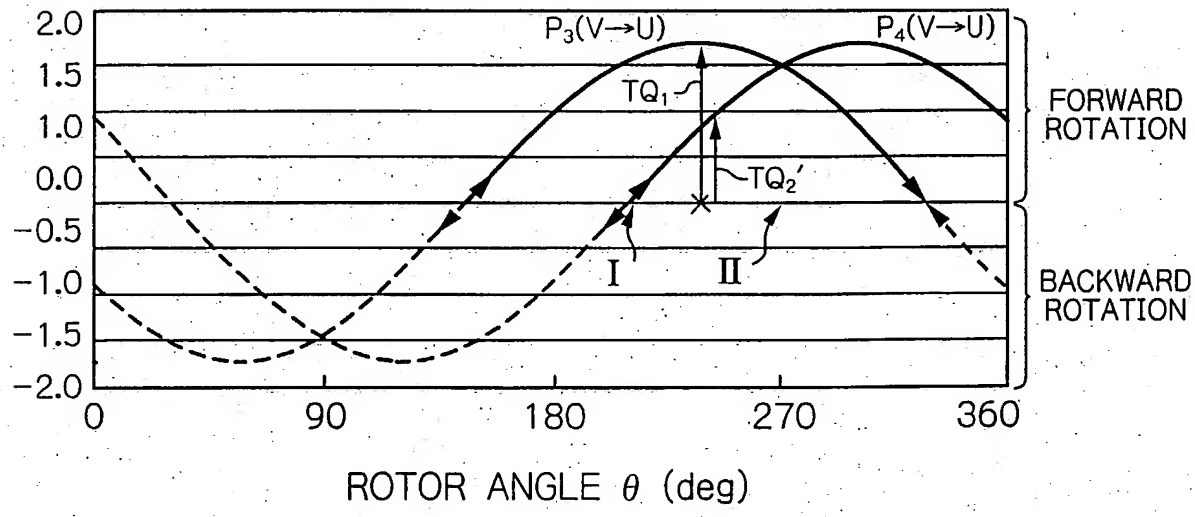
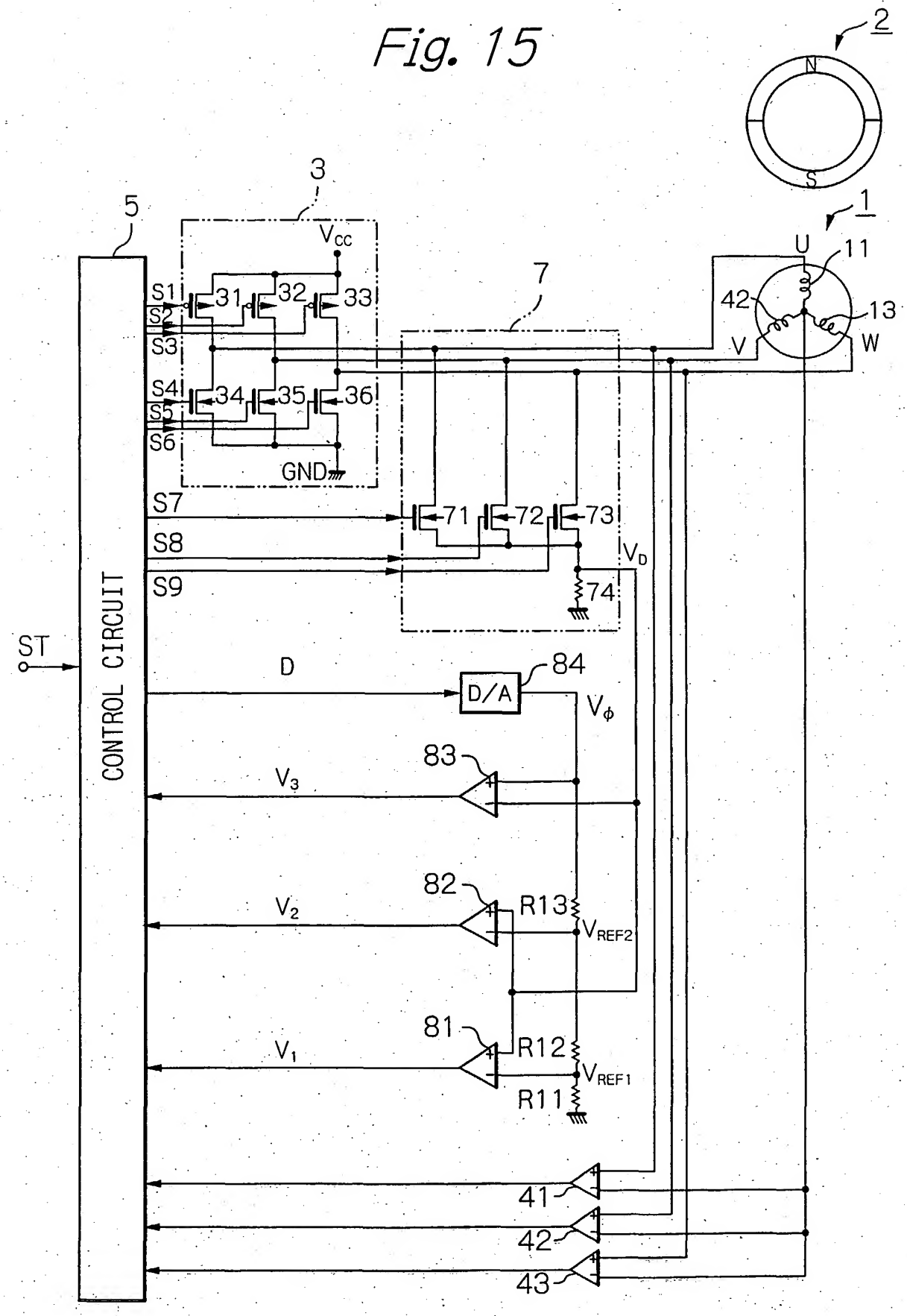


Fig. 15


2
N
S
1
3
5
7
V_{CC}
S1
S2
S3
S4
S5
S6
31
32
33
34
35
36
GND
U
11
42
13
V
W
S7
S8
S9
71
72
73
74
V_D
ST
CONTROL CIRCUIT
D
D/A
84
V_ϕ
83
V_3
82
V_2
R13
V_{REF2}
81
V_1
R12
V_{REF1}
R11
41
42
43